Etiology of osteoporotic fractures in post-menopausal women

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Osteoporosis is a prevalent problem amongst the elderly. Bone mineral density (BMD) obtained from dual X-ray absorptiometry (DXA) is the golden standard in diagnosing osteopenia ($-1.0 < t < -2.5$) and osteoporosis ($t > -2.5$). However, following osteoporosis therapy, increases in BMD may be unreliable. Although hip fracture risk can be reduced with the aid of drugs, treated patients still face considerable risk as most people who sustain hip fracture do not have generalized osteoporosis[1]. A study of the local distribution of bone mass was necessary as they contribute to the geometry and consequently the bone strength. By identifying the respective regions in the femoral neck, the geometric changes were localized and differed between each patient, proving that drug treatment elicits local changes in Rmean and CTmean. Numerical analysis also validated the above findings, where critical strain regions were predicted at similar zones and this is coherent with the fact that reduced thickness of the cortical bone has been related to increased risk of fracture initiation[2]. Hence, from individual radar plots, we can determine if the effect of drugs had outweighed the effect of aging. We can then propose a course of treatment drug better suited for the patient in the clinical scenario. Clinically, little conclusion can be drawn from just the BMD in osteopenic/ osteoporotic patients. This emphasizes the necessity of using geometry and structure to predict fracture risk. Focusing on a patient specific analysis at a local level will improve diagnosis of osteoporosis and ultimately fracture prediction.

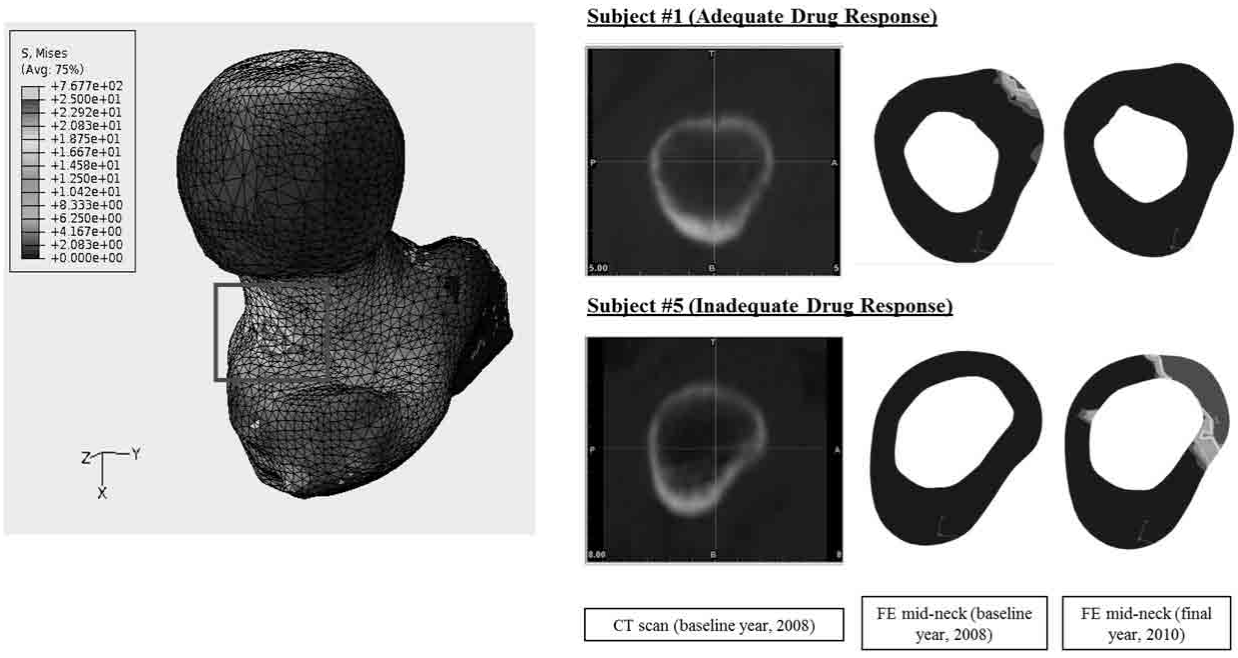

Fig. 1. Computational model for the femur (left) and Comparison of CT-scans, radar plots of buckling ratios and FE-images of femoral cross sections of two subjects from adequate and inadequate drug response groups respectively (right).

References

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